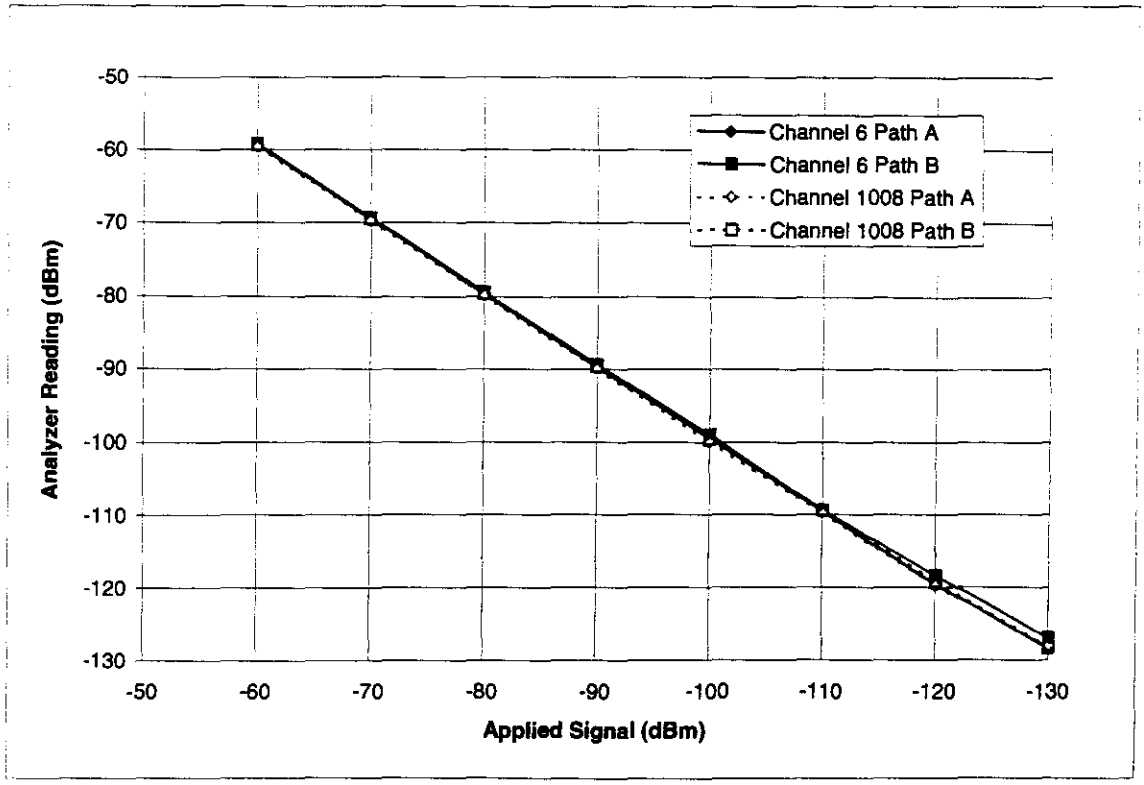


**Figure C.4 Analyzer reading vs. applied signal at reference point**

Figure C.4 shows the linearity of the spectrum analyzers. Linearity is acceptable to at least –120 dBm applied signal, and is only slightly degraded at –130 dBm. Thus, one can reasonably expect results to track site receiver data at levels above –120 dBm in cross-checking data sources in post processing.

# Appendix D - Technical Qualifications of Investigators

The principal investigators for this project were:

-Christopher J. Hall, P.E., M.S.E.E.
President, Wireless Systems Engineering, Inc., Satellite Beach, FL

-Jay Seward,
Senior RF Engineer, SAFCO Technologies, a division of Agilent Technologies, Melbourne, FL

-Ivica Kostanic, Ph.D. Candidate, E.E.
Senior RF Engineer, SAFCO Technologies, a division of Agilent Technologies, Melbourne, FL

Their resumes are attached on the following pages.

All are experienced in the technologies involved, and in the art of conducting controlled experiments in Cellular radio and other fields. These gentlemen are independent consultants, who were engaged by AirCell to conduct this experiment and provide a 'third party' evaluation of the results.

## Christopher J. Hall, P.E.

## SUMMARY OF QUALIFICATIONS

Mr. Hall is a licensed P.E. with over 20 years experience as a Cellular, PCS, Land Mobile, Terrestrial, Airborne and Satcom Systems Engineer, including detailed RF, Analog, Digital and Optical hardware design. He is familiar with modulation theory, antennas and propagation, error correcting coding, analog and digital signal processing, communications jamming, flight testing, and radar countermeasures.

## PROFESSIONAL EXPERIENCE

1998-Present **Wireless Systems Engineering, Inc.**, Satellite Beach, FL
**Principal Engineer and Partner.**

- General RF engineering consulting support to carriers, including frequency reuse planning, system configuration, site selection and growth recommendations for major markets, system troubleshooting, etc. Experienced in 800/900 MHz cellular radio and 1900 MHz PCS
- General RF, Analog, Digital, and Optical Systems engineering and hardware design consulting.
- Speech Processing algorithm development for speech quality scoring (Automated MOS scoring)
- E911 / Caller Location consultant for time of arrival systems.
- Design and construction of special purpose test equipment for the cellular/PCS industry.
- Independent "3rd party" evaluator and expert witness in cell site placement/zoning disputes.
- Expert "3rd party" evaluator in FCC and operational disputes regarding cellular/PCS carriers.
- Independent evaluator of RF radiation safety standards compliance for Cellular/PCS carriers.
- Flight Testing, ground testing. analysis, reporting, support and defense of technical filings.
- Teaching, training, and paid author.

1995-1998 **TEC CELLULAR, Inc.**, Melbourne, FL
**Senior RF Engineer**, Wireless Engineering Consulting Services.

- General RF engineering consulting support to customers, including frequency reuse planning for major cities, system configuration and growth recommendations for major markets, system troubleshooting, etc. Experienced in 800/900 MHz cellular radio and 1900 MHz PCS, including all major protocols; AMPS/NAMPS, TDMA, CDMA, GSM, ETACS.
- Flight testing, ground testing, analysis, reporting, and support relating to technical filings.
- Expert Witness in zoning and operational disputes concerning cellular carriers.
- Designed a 200+ cell CDMA PCS system covering over 12,000 square miles for a major PCS provider. The system is now under construction in the Midwest.
- Provided day-to-day site selection, cell design, cell upgrade, performance engineering, and traffic engineering for a 200+ cell cellular system encompassing 6 MSAs and 6 RSAs in the Northeast for over a year.
- Designed a CDMA cellular overlay encompassing 6 MSAs and 2 RSAs for a major cellular carrier in the Northeast. Handled system design, site selection, site equipment allocation, coverage prediction, handoff analysis, spectrum clearing issues, domestic and international coordination issues, and other technical issues related to CDMA in an AMPS environment.
- Teaching/Training of engineering staff. Have taught various cellular engineering short courses. (Also authored papers on CDMA design and cellular radio propagation effects.)

1994-1995 **American Electronics Laboratories,** Lansdale PA
**Senior Staff Consultant**, Intelligence Systems.

- Developed and integrated a cellular interception and jamming suite built into a small (airline carry-on) suitcase, having the capability to selectively intercept, monitor, identify, target, and deny cellular access to individual users, or deny general access over significant regions with its 100 watt transmitter. This development included identification and exploitation of AMPS air interface vulnerabilities to outside manipulation.
- Participated in proposal efforts and design analysis related to upgrading existing large scale military radio communications and jamming systems.
- Guided development of a system for transport of wideband RF signals over optical fiber.

1990-1994 **Harris Government Communications Systems Division,** Palm Bay FL
**Staff Engineer**, Systems Engineering Department, Analysis Group.

- Participated in the design and analysis of various intelligence collection systems.
- Participated in the design and analysis of numerous satellite, terrestrial, and air/land mobile communications systems, with significant experience in the areas of cellular telephone interception and fraud prevention.
- Mr. Hall is experienced both as a Systems Engineer and as an RF/analog/digital/optical hardware designer. He has worked with every aspect of RF system development, from concept definition and study through component level design, construction, debugging, and final acceptance testing.
- Experienced in optical systems, and was recently awarded U.S. Patent #5,612,778 for a multiple parameter fiber optic sensor.
- Mr. Hall was one of the founding members of the Law Enforcement Products group, where he specialized in cellular interception. He was responsible for the RF design of Triggerfish™ and Swordfish™, which remain in production. Mr. Hall also assisted in the development of Foxbat™, a covert audio surveillance device.

1986-1990 and
1981-1983 **Georgia Tech Research Institute,** Atlanta GA
**Research Engineer**, Systems Engineering Laboratory.

- Participated in the analysis, development, ground and flight testing of experimental radar countermeasures techniques. Mr. Hall specialized in Monopulse countermeasures techniques, with particular emphasis on coherent countermeasures such as Polarization, Cross Eye, and Double Cross. He and Dr. J. J. Landgren are co-inventors of a new class of technique which represents a major advance in the state of the art.
- Participated in mathematical and software modeling of radar systems, RF propagation, radar countermeasures systems and their interactions, with special emphasis on antenna characteristics.

1983-1986 **HRB-Singer (now HRB Systems),** State College PA
**Senior Engineer**, RF Collection Group.

- Contributed to RF collection (intelligence) systems definition, design, analysis, and construction.
- Designed and constructed high speed analog to digital (A/D) and digital to analog (D/A) subsystems.
- Defined, designed and developed a truck mounted interception/direction finding/jamming system covering 1.5-1200 MHz. This internally funded effort included design activities from air conditioning to hydraulic power system design.

1980-1981 **TRW Defense and Space Systems Group,** Redondo Beach CA
**Member of Technical Staff**, Systems Engineering Laboratory.

- Participated in the definition, design, and analysis of fiber optic, satellite and airborne communications systems, with emphasis on modulation and coding theory. Performed feasibility studies and 'blue sky' designs aimed at solving customer problems. Briefed customers on proposed systems.

## EDUCATION

1980 Master of Science, Electrical Engineering, Georgia Institute of Technology
1979 Bachelor of Electrical Engineering with Highest Honors, Georgia Institute of Technology
Member: Phi Kappa Phi, Tau Beta Pi, Eta Kappa Nu; engineering honor societies.

(Plus numerous short courses, in house courses, technical seminars, conferences, etc. relating to areas of technical competence.)

## Francis M. Seward, Jr.

## SUMMARY OF QUALIFICATIONS

Senior RF Engineer with sixteen years designing, testing, installing, commissioning, and troubleshooting Ground Communications Electronic Systems. Knowledgeable systems planner and problem solver. Firm grasp of RF and electronic theory. Excellent mentor for junior engineering personnel.

## PROFESSIONAL EXPERIENCE

8/95 – Present **SAFCO Technologies, a division of Agilent Technologies**, Melbourne, FL
**Senior RF Engineer**

- Provided iDEN channel planning services for Nextel Central and West Florida Markets during FY 2000/2001.
- Created a preliminary design of proposed New York, New Jersey, Pennsylvania, and Delaware 1900 MHz PCS CDMA network for SBC including New York City and Philadelphia.
- Perform Cellular and PCS network design and post design project management including: preliminary design, cell search area selection, propagation studies and candidate evaluation using our *WIZARD®* wireless planning tool. Assist clients with measured data collection, reduction, and analysis. Perform propagation model optimization and comparison of measured data with RF prediction yielding a well-planned system and a useful and accurate model.
- Develop and implement frequency and P/N reuse plans for AMPS cellular systems with CDMA and CDPD overlays. Analyze system interference of control, voice, and data channels with our *WIZARD®* wireless planning tool. Coordinate, implement, and field test frequency plans to ensure that the system performs as forecast. Take corrective actions where necessary to control RF footprint and interference issues through the manipulation of cell site and switch parameters.
- Solve market-peculiar coverage problems with case specific RF solutions on a regular basis.
- Perform intermodulation studies for clients in order that they may collocate with other providers.
- Coordinate technical aspects and legal issues of market build-out that involve the FCC and FAA.
- Familiar with all technical aspects of AMPS, CDMA, TDMA, and iDEN wireless standards.
- Manage personnel and assets in the completion of Cellular and PCS system build-out, licensing, system validation, frequency planning and coordination, and special projects for clients such as Nextel Communications, Verizon, SBC, BellSouth Cellular Corp., U.S. Unwired, United States Cellular, Ameritech Cellular, Frontier Cellular, AirCell, RamCell, and others.

3/93 - 8/95 **Satellite Transmission Systems,** Melbourne, FL
**Field Engineer**

- Authored and implemented in-plant and on-site test procedures for satellite communication equipment from end item to system level.
- Created link budgets and system level diagrams. Performed system stability tests, set system levels, and troubleshot faulty end items to the component level.
- Formulated solutions for special customer requirements.
- Commissioned numerous B & C class and four A class earth stations including systems acceptance tests and Intelsat SSOG verification tests of up to 20m parabolic antennae.

3/83 – 1/93 **United States Air Force,**
**Ground Radio Maintenance Technician/Manager**

- Managed installation & maintenance of fixed & deployable air traffic control, & long range radio.
- Performed preventive and corrective maintenance of air traffic and command and control systems.
- Installed and aligned UHF, VHF, and HF - AM, FM, and SSB radio sets, remote control units, modems, and antenna couplers and tuners, multichannel digital recorders, telephone equipment, line conditioners, deployable & fixed HF, UHF, & VHF antennae systems, and cryptographic gear.
- Performed ground up installation and relocation of air traffic facilities, radio sites, and physical security systems (BISS) for various restricted access facilities worldwide. Directed numerous installation projects continually surpassing Q.C. standards and customer expectations

## EDUCATION

Pursuing BS, Electrical Engineering Technology, University of Central Florida, Orlando, FL

AS, Electronic Systems Technology 1990, Community College of the Air Force,

AA, General Studies 1992, Brevard Community College, Cocoa, FL

## PROFESSIONAL TRAINING

SAFCO Technologies, Incorporated - RF Engineering and Continuing Education Courses
Cellular RF Engineering Course - Georgia Technical Institute, Atlanta, GA
AT&T Digital Test and Measurement Course – Earth Station Training Site, Melbourne, FL
Numerous Vendor Sponsored Technical Courses
Military Leadership and Management Course, RAF Upwood, U.K.
Standard Installation Practices, Kelly AFB, TX
6 Month Military Basic Electronics School, Keesler AFB, MS

# Ivica Kostanic

## SUMMARY OF QUALIFICATIONS

Cellular/PCS Senior RF Engineer for SAFCO Technologies, a Division of Agilent, Inc., an industry leader in wireless engineering consulting and software development. Strong technical background in CDMA, Information Processing, System Simulation and Modeling. Intimately familiar with following analog and digital wireless standards: AMPS/EAMPS(IS-533), NAMPS(IS-88), TDMA(IS-54,IS-136), CDMA(IS-95,IS-95A).

## PROFESSIONAL EXPERIENCE

12/97 – Present **SAFCO Technologies, A division of Agilent Technologies,** Melbourne, FL,
**Senior RF Engineer**

- Consulting services in evaluation of upcoming communication systems. Development and testing of software algorithms for simulation of wireless communication systems. Experienced in RF propagation modeling, frequency planning and system design. Development and teaching of wireless engineering classes. Evaluation of measurement data.
- Development of algorithms and software requirements for future releases of RF network engineering software tool *WIZARD®*.
- Development and teaching of training seminars in the areas related to the RF engineering field. Development and teaching of courses covering statistical propagation modeling, link budgets, frequency planning, drive testing, traffic planning, wireless system design principles, basic and intermediate IS-95 CDMA, IS-136 TDMA and GSM/PCS1900.
- Technical analysis of channel sounding and drive testing data. The data analysis include site validation, measured versus predicted analysis and improvement of *WIZARD®* prediction algorithms.
- Development of automatic frequency planning algorithm for channel planning assignments in AMPS, DAMPS, NAMPS and IS-136 TDMA cellular systems.
- Active role in the design of large IS-95 CDMA cellular network covering area of several states (Florida, Vermont, New Hampshire, New York, Pennsylvania, Virginia and West Virginia).
- Active role in a design of a large IS-136 TDMA cellular network in north and central Florida.
- Consulting services involving an RF design and optimization of a large in building IS-95 CDMA cellular network using micro-cell BS equipment and optical fiber distributed antenna systems for an international client in Singapore.
- Optimization of a large IS–95 CDMA cellular network in Tennessee.
- Technical evaluation of a proposed communication system allowing usage of existing cellular systems in radio communication with private planes.
- Technical evaluation of a proposed TDMA/CDMA, frequency hopping, point to multi point, communication system. This system is designed to provide large bandwidth Internet links.
- Technical evaluation of a proposed communication system used for the geographical location of mobile phone users. The system is to be utilized to provide location of the mobile phone originated 911 calls.

1994-1996, **Florida Institute of Technology**, Melbourne, FL,
**Teaching Assistant**

- Assisted in the instruction of Circuit Theory II Class.

## EDUCATION

1995 Master of Science in Electrical Engineering, Florida Institute of Technology
Systems and Information Processing Option

1993 Bachelor of Science in Electrical Engineering, University of Belgrade, Yugoslavia
Double Major: Electronics and Communication

# Appendix E - HP8921 Software Modification Listings

The TDMA test signal for BER measurements in this report was generated by an HP8921A test set with an HP83204A TDMA Adapter, loaded with modified HP11807B software. This software package provides test functions for Nortel TDMA base stations, and includes a number of programs and utilities. The program used for BER testing is filename "NT_BER" and is written in HP Instrument Basic. This is an interpreted language, and source code appears in the ROM card supplied by HP. This source code can be modified by users.

To speed testing and reduce the chance of human errors in testing, the code was modified by adding a 'loop' to the HP code, which caused the test set to take a measurement, output the measurement to a serial port (where it was captured by a laptop computer to a file), step the TDMA signal power by a specified amount, and repeat the process until a set power was reached.

In the process of making a measurement, the test set normally does a cable loss calibration, which requires mating and unmating connectors on the test setup. This was bypassed in the modified software, in favor of manually entered cable loss measurements because: The measurement might have fluctuated a few tenths of a dB each time, which would have directly affected the power level used to make *each* BER measurement. Calibrating once and entering identical cable loss values for all data points causes less drift. Further, the manual reconfiguration - mating and unmating connectors to measure cable loss in taking *each data point* would have slowed the measurement process dramatically, introduced potential for human errors, and worn the connectors to a point that this wear could have caused errors. Leaving the cabling untouched during the entire measurement series better ensured accurate, repeatable results.

Both SAFCO and WSE personnel examined the modified HP Instrument Basic code, made final changes, and verified that the BER calculation methodology and results were not affected by the modifications made.

This program is quite lengthy (approximately 160 pages) so it is impractical to list in its entirety here. The pages which follow show only the modified portions of the code, with breaks indicating omitted (unchanged) code segments. The lines shown in black are unchanged, struck out portions are deletions, and underlined segments are additions.

Code segments follow:

```
1   ! NT_TRU REV B.02.01
2   !####
3   !*******************************************!
4   ! _____ HP 11807B Option 044 Software _____  !
5   ! _____ HP 11807B Option H04 Software _____  !
6   ! (c) Copyright Hewlett_Packard Co. 1995     !
7   ! All rights reserved.                       !
8   ! NT_EXEC2  Rev date 03/17/99
9   !*******************************************!
36  !####
37  COM /Data_coll/ Dot$[5],F_t$[7],@Data_coll,INTEGER
Data_coll_on,R_file
43  COM /Pres_chan/ INTEGER Pres_chan
47  COM /Freq/ Rx_f,Tx_f
51  COM /I_o/ I_o$[250]
```

```
 56 COM /R_cond/ F$[1],R$[1],O$[1],D$[1]
 61 COM /Addr/ INTEGER Paddr,I1addr,I2addr,I3addr,I4addr
 66 COM /User/ U$(1:5)[80],U(1:15)
 71 COM /P_f/ INTEGER Ps,Fl
 75 COM /Prt/ P$(1:18)[50],INTEGER P
 79 COM /Scr/ Scr$[1]
 83 COM /P_tst/ INTEGER P_tst
 87 COM /Prt_cont/ INTEGER Lns,Mx,Sf,Ef
 95 COM /Filt_opt/ Flt_1$[9],Flt_2$[9]
101 COM /Cur_opt/ Cur$[3]
107 COM /Pres_scr/ Pres_scr$[10]
114 COM /Disp_t/ T$[50]
118 COM /Sw_pol/ INTEGER Act_low_ant,Act_low_pa
123 COM /Ts_mod/ Ts_mod$[10],Ts_rev$[7]
128 COM /S_time/ S_time
132 COM /Run_ts/ Run_ts
133 COM /Losses/ Rx loss(1:6),Tx loss,Split loss,Rmc gain(1:6)
133.1 COM /Low cjh/ Low cjh(1:18)
133.2 COM /Hi cjh/ Hi cjh(1:18)
134 Rx loss(1)=2.5
135 Rx loss(2)=Rx loss(1)
136 Rx loss(3)=Rx loss(1)
137 Rx loss(4)=Rx loss(1)
138 Rx loss(5)=Rx loss(1)
139 Rx loss(6)=Rx loss(1)
140 Tx loss=.8
141 Low cjh(1)=-116
142 Hi cjh(1)=-102
143 To ts("TEST:PAR:NUMB 2,"&VAL$(Hi cjh))
144 To ts("TEST:PAR:NUMB 20,"&VAL$(Low cjh))
146 INTEGER Ch
147 Pre setup
~~137~~148 Slc(Name$)
~~138~~149 Sgr:CLEAR SCREEN
~~139~~150 Pres_scr$="RX"
~~140~~151 Disp_title(" ")
~~141~~152 ON KEY 1 LABEL "Stop Test",10 CALL Stp_test
~~142~~153 ENABLE
~~143~~154 ON ERROR RECOVER No_7
~~144~~155 ON TIMEOUT 7,5 RECOVER T_out
~~145~~156 No_7:OFF ERROR
~~146~~157 CLEAR 800
~~147~~158 OUTPUT 800;"*ESR?"
~~148~~159 ENTER 800;Resp
~~149~~160 U(13)=0
~~150~~161 IF BIT(Resp,7) THEN U(13)=1
~~151~~162 Mod_rev
~~152~~163 Chk_mod_rev
~~153~~164 IF Cur$="" THEN CALL Opt(Flt_1$,Flt_2$,Cur$)
~~154~~165 To_ts("CONF:KNOB 'OFF'")
~~155~~166 To_ts("*CLS")
~~156~~167 S_time=TIMEDATE
~~157~~168 Gti
~~158~~169 Set_data_coll
~~159~~170 Lns=0
~~160~~171 IF Sf THEN CALL Prt_mess("
","")
```

```
~~161~~172 Init_sys
~~162~~173 Prt_header(0)
~~163~~174 Ch=1
~~164~~175 Test_once=0
~~165~~176 IF Pres_chan>50 THEN Test_once=1
~~166~~177 Pres_chan=0
~~167~~178 Rep:REPEAT
~~168~~179 IF NOT Test_once THEN
~~169~~180 IF Ch<=0 THEN Ch=1
~~170~~181 IF Ch>50 THEN Ch=50
~~171~~182 Enter_str_ts("TESTS:FREQ? "&VAL$(Ch),I_o$)
~~172~~183 Rx_f=VAL(I_o$[4;12])
~~173~~184 Tx_f=VAL(I_o$[30;12])
~~174~~185 Rx_ch$=TRIM$(I_o$[17;12])
~~175~~186 Tx_ch$=TRIM$(I_o$[43;12])
~~176~~187 IF Tx_f=-1 OR Rx_f=-1 THEN GOTO Quit
~~177~~188 IF POS(Tx_ch$,"-1")<>0 OR POS(Rx_ch$,"-1")<>0 THEN GOTO Quit
~~178~~189 T_it$=I_o$[56;1]
~~179 ELSE~~
~~180 T_it$="Y"~~
~~181~~190 ELSE
191 T_it$="Y"
192 END IF
~~182~~193 IF T_it$="Y" THEN
~~183~~194 Run_ts=1
~~184~~195 REPEAT
~~185~~196 Enter_str_ts("TESTS:SEQN? "&VAL$(Run_ts),I_o$)
~~186~~197 Tst=VAL(I_o$[4;2])
~~187~~198 Tst$=I_o$[7;1]
~~188~~199 IF Tst AND Tst$="Y" THEN
~~189 P_tst=ABS(Tst)~~
~~190 Chge_to_ch(Ch)~~
~~191 SELECT Pres_chan~~
~~192 CASE 999~~
~~193 Tst=0~~
~~194 Pres_chan=Ch~~
~~195 CASE 9999~~
~~197 Tst=0~~
~~198 Pres_chan=0~~
~~199 CASE 1111~~
~~200 Tst=0~~
~~201 Pres_chan=Ch~~
~~202 CASE ELSE~~
~~203 GOSUB Pt~~
~~204 END SELECT~~
~~205 END IF~~
~~206~~200 P_tst=ABS(Tst)
201 Chge_to_ch(Ch)
202 SELECT Pres_chan
203 CASE 999
204 Tst=0
205 Pres_chan=Ch
206 CASE 9999
207 Tst=0
208 Pres_chan=0
209 CASE 1111
210 Tst=0
```

```
211 Pres_chan=Ch
212 CASE ELSE
213 GOSUB Pt
214 END SELECT
215 END IF
216 Run_ts=Run_ts+1
207217 UNTIL Tst=0 OR Run_ts=51
208218 END IF
209219 Ch=Ch+1
210220 UNTIL Ch=51 OR Test_once
211221 Quit:ON ERROR RECOVER No_to_k
212222 ON TIMEOUT 7,5 RECOVER Kick_out
213223 No_to_k:OFF ERROR
214224 DISP "Testing complete."
215225 Prt_end_info(Test_once,Rep_seq)
216226 IF Rep_seq=1 AND Pres_chan<>0 THEN
217227 Ch=Pres_chan
218228 Pres_chan=0
219229 GOTO Rep
220230 END IF
221231 IF Data_coll_on THEN
222232 OUTPUT @Data_coll;"***END OF DATA***"
223233 IF I4addr<>10 THEN ASSIGN @Data_coll TO *
224234 Data_coll_on=0
225 END IF
226235 END IF
236 Lns=1
227237 IF Ef THEN CALL Prt_mess("","")
228 FOR N=1 TO 3
229 FOR K=1 TO 4
230 BEEP 1000,.05
231 IF K=4 THEN
232 IF N=1 OR N=2 THEN WAIT .5
233 ELSE
234 WAIT .05
235 END IF
236 NEXT K
237 NEXT N","")
238 Kick_out:!
239 PAUSEParm increment
240 GOTO Sgr
241 T_out:PRINT "Timeout error from an external instrument."
242 PRINT "All testing aborted."
243 GOTO Quit

:
:
:

693 Opt:SUB Opt(Flt_1$,Flt_2$,Cur$)
700 COM /I_o/ I_o$
701 I_o$=FNTs_mod$
702 IF POS(I_o$,"8921")<>0 THEN
703 Flt_1$="C MESSAGE"
704 Flt_2$="6kHz BPF"
705 Cur$="YES"
706 SUBEXIT
```

```
707 END IF
708 IF POS(FNTs_mod$,"8920B")<>0 THEN
709 L=4
710 ELSE
711 L=6
712 END IF
713 Enter_str_ts("*OPT?",I_o$)
714 FOR N=1 TO L
715 Pos_c=POS(I_o$[Rl_7+1],",")
716 Rl_7=Pos_c+Rl_7
717 NEXT N
718 Rl_8=POS(I_o$[Rl_7+1],",")+Rl_7
719 Rl_9=POS(I_o$[Rl_8+1],",")+Rl_8
720 IF Rl_8=Rl_9 THEN Rl_9=LEN(I_o$)+1
721 Flt_1$=TRIM$(I_o$[Rl_7+1,Rl_8-1])
722 Flt_2$=TRIM$(I_o$[Rl_8+1,Rl_9-1])
723 Cur$="NO"
724 IF POS(I_o$,"I/O OPTION")<>0 OR L=4 THEN Cur$="YES"
725 SUBEND
727 Pause_:SUB Pause_
731 OFF KEYGOTO Cont
732 ON KEY 2 LABEL "Continue",15 GOTO Cont
733 LOOP
734 WAIT .2
735 END LOOP
736 Cont:OFF KEY
737 SUBEND
739 Prt_crt:SUB Prt_crt(M$)
746 COM /Prt/ P$(*),INTEGER P
747 P=P+1
748 IF P>18 THEN P=1
749 P$(P)=M$
750 PRINT M$
751 SUBEND
753 Prt_header:SUB Prt_header(Crt_only)
760 COM /Addr/ INTEGER Paddr,I1addr,I2addr,I3addr,I4addr
761 COM /Losses/ Rx loss(*),Tx loss,Split loss,Rmc gain(*)
763 COM /Data_coll/ Dot$,F_t$,@Data_coll,INTEGER Data_coll_on,R_file
762764 COM /I_o/ I_o$
763765 IF Data_coll_on THEN OUTPUT @Data_coll;"***START OF DATA***"
766 IF Data_coll_on THEN OUTPUT @Data_coll;"RxLoss= ";Rx_loss(1);" dB
TxLoss= ";
Tx_loss
764768 Enter_str_ts("CONF:DATE?",D$)
765769 Enter_str_ts("CONF:TIME?",T$)
766770 OUTPUT I_o$ USING "#,15A,X,6Z,5X,12A,X,ZZ.DD";"Date
[MM/DD/YY]",VAL(D$),"Tim
e [HH.MM]",VAL(T$)
767771 Prt_mess(I_o$,"")
768772 Enter_str_ts("TEST:COMM1?",I_o$)
769773 I_o$=I_o$[2,LEN(I_o$)-1]
770774 IF LEN(TRIM$(I_o$))>0 THEN GOSUB Prt_it
771775 Enter_str_ts("TEST:COMM2?",I_o$)
772776 I_o$=I_o$[2,LEN(I_o$)-1]
773777 IF LEN(TRIM$(I_o$))>0 THEN GOSUB Prt_it
774778 Enter_str_ts("TEST:EXEC:HEAD1?",I_o$)
775779 I_o$=I_o$[2,LEN(I_o$)-1]
```

```
776780 IF LEN(TRIM$(I_o$))>0 THEN GOSUB Prt_it
777781 Enter_str_ts("TEST:EXEC:HEAD2?",I_o$)
778782 I_o$=I_o$[2,LEN(I_o$)-1]
779783 IF LEN(TRIM$(I_o$))>0 THEN GOSUB Prt_it
780784 F1:IMAGE #,50("=")
781785 F1a:IMAGE #,"Test conditions",14X,"Measured value",4X,"P/F"
782 OUTPUT I_o$ USING F1
783 Prt_crt(I_o$)
784 OUTPUT I_o$ USING F1a
785 Prt_crt(I_o$)
786 OUTPUT I_o$ USING F1
787 Prt_crt(I_o$)
788 OUTPUT I_o$ USING F1a
789 Prt_crt(I_o$)
790 OUTPUT I_o$ USING F1
791 Prt_crt(I_o$)
792 IF Crt_only THEN SUBEXIT
789793 F2:IMAGE #,"Test conditions",14X,"Measured value",7X,"Lower
limit",2X,"Upper
 limit",2X,"P/F"
790794 OUTPUT I_o$ USING F2
791795 Prt_mess(RPT$("=",79),I_o$)
792796 Prt_mess(RPT$("=",79),"")
793797 SUBEXIT
794798 Prt_it:Prt_crt(I_o$)
795799 Prt_mess(I_o$,"")
796 RETURN
797800 RETURN
801 SUBEND
799802 Prt_mess:SUB Prt_mess(M1$,M2$)
804 COM /Data_coll/ Dot$,F_t$,@Data_coll,INTEGER Data_coll_on,R_file
805 COM /Addr/ INTEGER Paddr,I1addr,I2addr,I3addr,I4addr
806 COM /R_cond/ F$,R$,O$,D$
807 COM /Prt_cont/ INTEGER Lns,Mx,Sf,Ef
808 IF Data_coll_on THEN
809 IF M1$<>"" THEN OUTPUT @Data_coll;M1$
810 IF M2$<>"" THEN OUTPUT @Data_coll;M2$
811 END IF
812 IF D$<>"P" OR Paddr=0 THEN SUBEXIT
813 Sc=Paddr
814 IF Paddr>100 THEN Sc=Paddr DIV 100
815 Take_2:ON TIMEOUT Sc,10 GOTO E1
816 ON ERROR GOTO Z1
817 IF M1$<>"" THEN
818 OUTPUT Paddr;M1$
819 GOSUB Chk_lns
820 END IF
821 IF M2$<>"" THEN
822 OUTPUT Paddr;M2$
823 GOSUB Chk_lns
824 END IF
825 SUBEXIT
826 E1:DISP "Timeout from printer at address ";Paddr;". Retry?"
827 BEEP
828 IF FNYes_no$="YES" THEN
829 DISP
830 GOTO Take_2
```

```
831 END IF
832 DISP "Program terminated."
833 Stop_

:
:
:

13850 Bs_info:SUB Bs_info(A_ch,Slot$)
13854 OFF KEY
13855 COM /Losses/ Rx_loss(*),Tx_loss,Split_loss,Rmc_gain(*)
13856 COM /Site_info/ Bs$,Pa_type$,Tx_pow,Sector$,Gain_x,Gain_y,Gain_z
13857 COM /User/ U$(*),U(*)
13858 COM /I_o/ I_o$
13859 DIM Sel$(1:22)[47],Sel_type$(1:13)[17]
13860 INTEGER Offset,Cur_y,Len_list,Cur_y2,Len_list2,Cur_y3,Len_list3
13861 INTEGER Cur_y4,Len_list4
13862 INTEGER Cur_loc2,Cur_loc3,Cur_loc4
13863 INTEGER X,Y,W,H
13864 CLEAR SCREEN
13865 Disp_t("Initialization Screen")
13866 Tx_loc=FNFind_parm(43)
13867 Rd_tru_pow=FNFind_parm(40)
13868 Incr=1
13869 IF Rd_tru_pow THEN Incr=0
13870 IF Bs$="TRU2/FMPA+" OR POS(Bs$,"MCPA")<>0 THEN Incr=1
13871 Cur_y=1
13872 Offset=0
13873 Rxa=FNFind_parm(37)
13874 Rxb=FNFind_parm(38)
13875 IF POS(Sector$,"PARM") THEN
Sector$="PARM("&VAL$(Rxa)&","&VAL$(Rxb)&")"
13876 LOOP
13877 Disp_title("Use knob to select the transceiver configuration.")
13878 R_disp_t
13879 GOSUB Fill_sel
13880
~~Sel=FNSel_list(Sel$(*),3,1,Len_list,18,46,Cur_y,Offset,2,0,0)~~Sel=1
13881 SELECT Sel
13882 CASE -1
13883 Kick_out=1
13884 CASE -2
13885 Prt_dbm_w
13886 Cur_home
13887 R_disp_t
13888 CASE 1
13889 Kick_out=1
13890 CASE 2
13891 A_ch=FNInput_chan(A_ch,0)
13892 CASE 3
13893 Slot=1
13894 ON ERROR RECOVER Slot_err
13895 Slot=VAL(Slot$)

:
:
:
```

```
14806 Disp_dru_setup:SUB Disp_dru_setup(Dru$)
14810 COM /Site_info/ Bs$,Pa_type$,Tx_pow,Sector$,Gain_x,Gain_y,Gain_z
14811 Disp_1:CLEAR SCREEN
14812 Disp_t("Prepare TRU for testing")
14813 PRINT "Remove TRU in Slot "&Dru$&" from service."
14814 PRINT " "
14815 PRINT "Connect a 6 wire RJ-12 cable from the "&FNTs_mod$
14816 PRINT "serial B port to the RJ-12 to DB-25 adapter."
14817 PRINT "Connect the RJ-12 to DB-25 adapter to the"
14818 PRINT "DB-25 to RJ-45 adapter."
14819 PRINT "Connect an 8 wire RJ-45 cable from the"
14820 PRINT "DB-25 to RJ-45 adapter to the 8-pin teledapt"
14821 PRINT "jack on slot "&Dru$&"."
14822 PRINT " "
14823 IF POS(Bs$,"TRU3") THEN
14824 PRINT "Ensure the TRU is 'ROM IDLE' by verifying the"
14825 PRINT "following LED states."
14826 PRINT "  ON       LOS      FAIL     CCH     LCR     TX"
14827 PRINT " green     off      off     green   green    off"
14828 PRINT " "
14829 ELSE
14830 PRINT "Ensure that the TRU display shows 'ROM IDLE'."
14831 PRINT "If the display shows 'FLSH CHK' or the firmware"
14832 PRINT "load number, wait until it shows 'ROM IDLE'."
14833 PRINT " "
14834 PRINT " "
14835 END IF
14836 PRINT "If the TRU is in test mode, reset the TRU by"
14837 PRINT "pushing the 'Reset TRU' key (k1).  After several"
14838 PRINT "seconds the TRU should return to 'ROM IDLE'.";
14839 Disp_title("Read the following instructions then press the
Start Tst US
ER key to begin testing.")
14840 OFF KEY
14841 BEEPGOTO Tst
14842 ON KEY 1 LABEL "Reset TRU",5 GOTO R_dru
14843 ON KEY 2 LABEL "Start Tst",5 GOTO Tst
14844 LOOP
14845 WAIT .2
14846 END LOOP
14847 Tst:CLEAR SCREEN
14848 DISP
14849 Disp_title(" ")
14850 OFF KEY
14851 Reprt_crt
14852 SUBEXIT
14853 R_dru:OFF KEY
14854 Disp_title(" ")
14855 DISP "Waiting 5 seconds for TRU Slot "&Dru$&" to reset. . ."
14856 Cnt_bs("X")
14857 WAIT 1
14858 Cnt_bs("EXECUTE RESET")
14859 WAIT 5
14860 DISP
14861 GOTO Disp_1
14862 SUBEND
```

```
14864 Done_testing:SUB Done_testing
14868 Cnt_bs("EXECUTE RESET")
14869 DISP "Testing of this transceiver complete."
14870 SUBEND

:
:
:

15039 Draw_config
15040 Draw_rf(Rf_c$,0)
15041 Draw_dupl(Dupl_c$,0)
15042 Disp_title("Connect the Test Set to the Cell Site as shown.
Press Conti
nue when ready.")
15043 BEEP 1000,.15GOTO G_out
15044 BEEP 1250,.1
15045 OFF KEY
15046 ON KEY 2 LABEL "Continue",5 GOTO G_out
15047 N=1
15048 LOOP
15049 N=N*(-1)
15050 PEN N
15051 IF Rf THEN CALL Draw_rf(Rf_c$,1)
15052 IF Dupl THEN CALL Draw_dupl(Dupl_c$,1)
15053 END LOOP
15054 G_out:OFF KEY

:
:
:

16314 P_rep_cont:SUB P_rep_cont(Rep_flag)
16321 COM /User/ U$(*),U(*)
16322 COM /P_f/ INTEGER Ps,Fl
16323 IF Rep_flag=99 THEN
16324 Rep_flag=0
16325 ELSE
16326 OFF KEY
16327 IF Rep_flag=-99 THEN
16328 Disp_title("To proceed to next test, press Continue.")
16329 ELSE
16330 Disp_title("To repeat previous test, press Repeat.          To
proceed t
o next test, press Continue.")
16331 ON KEY 1 LABEL "Repeat",8 GOTO Rep
16332 END IF
16333 ON KEY 2 LABEL "Continue",8 GOTO Continue
16334 ON KEY 4 LABEL "Abort",8 GOTO Abort
16335 ON KEY 5 LABEL "Laptop",8 CALL T34
16336 BEEP 400,.2
16337 BEEP 1000,.2GOTO Continue
16338 LOOP
16339 WAIT .2
16340 END LOOP
16341 Rep:Rep_flag=1
```

```
16342 Prt_mess_both("***Re-measure: Previous results are
disregarded.","")
16343 GOTO Thats_all
16344 Abort:Rep_flag=-1
16345 Prt_mess_both("***Test sequence Aborted.","")
16346 U$(4)="ABORT"
16347 Fl=Fl+1
16348 GOTO Thats_all
16349 Continue:Rep_flag=0
16350 Thats_all:OFF KEY
16351 Disp_title(" ")
16352 END IF
16353 SUBEND

:
:
:
:

22867 Ver_tdma:DEF FNVer_tdma$
22872 COM /Ts_mod/ Ts_mod$,Ts_rev$
22873 COM /Iq_info/ Iq_modem$,Rx_dsp_rev,Tx_dsp_rev
22874 COM /User/ U$(*),U(*)
22875 Tdma_valid$="YES"
22876 IF Iq_modem$="TDMA" THEN
22877 IF VAL(Ts_rev$[3])<15. THEN
22878 Tdma_valid$="NO"
22879 Prt_mess_both(FNTs_mod$&" FW must be greater or equal to
15.00.","")
22880 END IF
22881 IF (Tx_dsp_rev<1.9960114E+7 OR Rx_dsp_rev<1.9960129E+7) AND
U(5)<>1 THEN
22883 Tdma_valid$="NO"
22884 Prt_mess_both("RX DSP rev must be greater or equal to
19960129","")
22885 Prt_mess_both("TX DSP rev must be greater or equal to
19960114","")
22886 END IF
22887 IF Rx_dsp_rev=-1 THEN
22888 Tdma_valid$="NO"
22889 Prt_mess_both("Communication failure with RX DSP on TDMA
Adapter.","")
22890 END IF
22891 IF Tx_dsp_rev=-1 THEN
22892 Tdma_valid$="NO"
22893 Prt_mess_both("Communication failure with TX DSP on TDMA
Adapter.","")
22894 END IF
22895 ELSE
22896 Tdma_valid$="NO"
22897 IF Iq_modem$="NO" THEN
22898 Prt_mess_both("TDMA Adapter not present or not responding.","")
22899 ELSE
22900 Prt_mess_both("TDMA Adapter is not the correct version.","")
22901 END IF
22902 END IF
22903 RETURN Tdma_valid$
```

```
22904 FNEND
23000 Pre_setup:SUB Pre_setup
23002 COM /Test_parm/ Parm20,Parm20inc,Parm20end
23010 Parm20=FNFind_parm(20)
23020 Parm20inc=FNFind_parm(1)
23030 Parm20end=FNFind_parm(2)
23099 SUBEND
23100 Parm_increment:SUB Parm_increment
23102 COM /Test_parm/ Parm20,Parm20inc,Parm20end
23110 Parm20=Parm20+Parm20inc
23120 IF Parm20>Parm20end THEN GOTO End_test
23130 To_ts("TEST:PAR:NUMB 20,"&VAL$(Parm20))
23140 SUBEXIT
23150 End_test:!
23152 FOR N=1 TO 3
23154  FOR K=1 TO 4
23156   BEEP 1000,.05
23158   IF K=4 THEN
23160    IF N=1 OR N=2 THEN WAIT .5
23162   ELSE
23164    WAIT .05
23166   END IF
23168  NEXT K
23170 NEXT N
23180 STOP
23199 SUBEND
```

# TEST REPORT

## AirCell / CDMA Compatibility Test
## February, 2002


**Prepared by**
**Christopher Hall, P.E.**

**in association with**
**Jay Seward**
**of SAFCO Technologies Inc.**
**(a division of Agilent Technologies)**



***Wireless Systems Engineering, Inc.***

424 Bridgetown Court, Satellite Beach, Florida, 32937
Phone: (321) 777-7881
Fax: (321) 777-7880
Email: CJHall@WirelessSystemsEngineering.com

# Introduction

This report details testing done at the request of AirCell, Inc. by Wireless Systems Engineering (WSE) and SAFCO, a division of Agilent Technologies. This report is designed to be useful to several audiences, and is organized in order of increasing technical detail.

Section 1 is an Executive Summary primarily intended for managerial personnel, interested mainly in the overall scope of the test and the 'bottom line' conclusions that were drawn.

Sections 2 through 6 and the Appendices provide full details of the test, both as backup material for the previous sections, and for engineering personnel who are interested in specific test details and/or wish to make a critical assessment of the procedures, data, results, and conclusions drawn herein.

Table of Contents

## Figures



## Tables